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THE EFFECTS OF THE ECB'S UNCONVENTIONAL MONETARY POLICIES ON STOCK MARKETS

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Abstract

The purpose of this research is to analyse the impact of the ECB's unconventional monetary policies on European Stock Markets since the beginning of the financial crisis. In order to do so, I conduct an event study founded on the application of three different models, which are robust to the heteroscedasticity and autocorrelation of daily stock returns. My results suggest that the ECB's unconventional monetary policy announcements had significant and positive effects on Italian, Spanish and Portuguese equities. Contrarily, the impact is negative for German stocks. Regarding the industries, the highest positive impact was on the banking sector.

Keywords: ECB Unconventional Policies, European Stock Markets, Event Study

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1. Introduction

During recent years, the Eurozone felt the impact of the economic crisis in different ways. Firstly, the relatively fragile banking sector was facing large capital losses, which contributed to a liquidity drought in the "real economy". Secondly, various countries' economies, particularly the ones with vast Government debt levels, were affected by the rapidly rising bond yield spreads. In order to respond to these challenges, the ECB started by cutting policy rates, with these reaching the zero lower bound. However, given the magnitude of the crisis, and the structure of the Eurozone, which is a currency union without fiscal union, the ECB had to follow other central bank's actions and implement non-standard policies. Nonetheless, there is still disagreement regarding the effectiveness of ECB's unconventional measures. While some commented that the polices reduced redenomination and default risks and improved the health of the banking system, others argue that such measures diminish the need for fiscal discipline, create all sorts of moral hazard problems and could lead to inflation or asset bubbles (Belke, 2013).

Most of the previous literature is focused on the effects of ECB's unconventional policies on government bond yields, interbank rates and credit default swap markets. However, it is always important to examine how monetary policy intervention influences stock market returns. Theoretically, if we consider the dividend discount model for equity valuation, we can see that monetary policy can affect stock prices by changing the discount rate for future cash flows and by potentially affecting the output in the short to medium term (Kontonikas & Kostakis, 2013). Additionally, monetary policy influences the way market agents perceive future economic conditions, thereby impacting their asset allocation decisions via the expectations channel (Falagiarda & Reitz, 2015) .

With the former ideas in mind, I decided to conduct an event study approach in order to find whether ECB's unconventional monetary policy announcements had statistically significant effects on European Stock Markets. Following the approach suggested by Krishnamurthy et al. (2014), I use a time-series dummy variable regression. The model includes dummies for six ECB unconventional programs (LTRO, CBPP, SMP, OMT, TLTRO and APP) and it is applied for twelve national and nineteen sectorial stock indices. Since my daily stock returns data is characterized by the presence of heteroscedasticity and autocorrelation, the Ordinary Least Squares (OLS) method is no longer the best linear unbiased estimator (BLUE) (Brown & Warner, 1985). Consequently, in order to adjust the covariance matrix for heteroscedasticity and autocorrelation, I decided to follow the methodology applied by Ioannidis & Kontonikas (2008) and use Newey-West standard errors with 5 lags.

The analysis of the announcements suggests that some of them were not considerably meaningful for stock investors. Therefore, in order to find which ones were significant enough to affect the equity markets, I follow the approach of Galariotis et al. (2017) and specify which of these ECB announcements were covered by Financial Times' headline articles. Then, I use a time-series dummy variable regression that only takes into account the "Important Announcements". Following Falagiarda & Reitz (2015), I also decided to look for anticipation and delayed effects.

In addition to the previous two models, I decided to conduct another regression, which builds on the methodology of Rogers et al. (2014) and Haitsma et al. (2015). This approach uses the yield spread between German and Italian 10-year government bonds at the day of an ECB announcement, in order to find unconventional monetary policy surprises and study their impact on equity markets.

Previewing our results, we find that the SMP and APP programs had a positive influence on the stock markets of peripheral nations. Nevertheless, the impacts of other programs are mostly insignificant for European equities. Taking into account the model that includes only the "Important Announcements", the results confirm that ECB unconventional monetary policy announcements benefited the peripheral European stock markets, which is in accordance with the findings of earlier literature. However, the measures led to negative abnormal returns in German stocks. Moreover, the results indicate mostly insignificant anticipation and delayed announcement effects. Finally, the results for the third model show that an announcement that causes a decrease in the yield spread between German and Italian government bonds also leads to an increase in the returns of stock indices, for the IPS countries.

At an industry level, the results for the various ECB programs show less significant effects, and only for the SMP and APP programs. However, in the case of the second model, which considers the "Important Announcements", the results show evidence of significant and positive effects on the Banking sector, but also on the Real Estate and Insurance industries' stock returns. In terms of anticipation and delayed effects, there is no evidence of their existence. Finally, the results for the third model, which considers the measure of unconventional policy surprises, are in line with the aforementioned findings.

In summary, this thesis contributes to the existing literature in four ways. First, I examine the impact of ECB unconventional monetary policy on stock prices, by distinguishing the effects of six programs. Second, I analyse the magnitude of the announcements with the objective of finding which ones are more meaningful for the common equity investor. Third, for my event study, I build on the methodology of other authors and use three different models which are robust to heteroscedasticity and autocorrelation of daily stock data. Lastly, I study the effects of ECB's unconventional policy on both domestic and industry stock indices.

The remainder of this paper is structured as follows. The following section contains theoretical content that analyses the ECB's Monetary Policy. Section 3 examines the previous literature on this subject. Section 4 outlines the different hypotheses for the event study. Section 5 outlines my data and methodology. Following that, section 6 presents my results and section 7 concludes and describes the limitations of this work.

2. The ECB's Monetary Policy

2.1 Objectives and Instruments of Monetary Policy

According to the Maastricht Treaty, the primary objective of the ECB's monetary policy is to maintain price stability (European Central Bank, 2017). Although the Treaty does not specify a definition of price stability, the ECB's Governing Council aims at keeping euro area inflation levels below, but close to 2% over the medium term. The maintenance of relatively stable prices is a key fundamental to achieve economic growth and welfare. The stability of prices in the EU brings more transparency and confidence to the market, increasing consumption, investment and employment.

The ECB monetary policy is based on the constant analysis of economic and monetary conditions, which guide the ECB's Governing Council decisions. The Council meets every month to analyse the Euro economic environment and decide on the appropriate level of the key interest rates (European Central Bank, 2017), which are described below:

- **The interest rate on the main refinancing operations (MRO):** in the form of a fixed or a variable rate, it provides the bulk of liquidity to the banking system. It is the equivalent to the U.S federal funds rate.
- **The rate on the deposit facility:** it is the rate paid by the ECB for money deposited overnight by euro area banks.
- **The rate on marginal lending facility:** it is the rate that banks pay in order to obtain overnight credit from the Euro system. It acts as a last resort for banks.

Besides influencing the rates in the Eurozone, the ECB also manages the liquidity supply through regular open market operations. These can be divided in two main types: the **Main Refinancing Operations (MROs)** and the **Long Term Refinancing Operations (LTROs).** MROs serve to provide liquidity in a weekly basis to the banks. They are used to "steer short-term interest rates, to manage the liquidity situation and to signal the monetary policy stance in the euro area" (European Central Bank, 2017). LTROs offer liquidity for a period of 3 months. "They provide additional, longer-term refinancing to the financial sector". Apart from the MROs and LTROs, the ECB can use fine-tuning operations to quickly respond to unforeseen changes in the liquidity supply in the money markets (De Nederlandsche Bank, 2017).

Lastly, the ECB can also use communication policies to conduct monetary strategy. Communication can be used to explain decisions, describe policies' objectives and results, and provide forward guidance. Due to the risk of loss of credibility and reputation and the presence of unusually negative conditions, central banks' communication became a stronger element of monetary policy during the crisis.

2.2 ECB Unconventional Policies

Unconventional monetary policies can be defined as a class of operations that use central banks' balance sheets in order to directly affect a broader set of market rates, asset prices and even lending amounts (Meier, 2009). In short, they act by changing the market agents' expectations and rebalancing their portfolios (Falagiarda & Reitz, 2015).

In the case of the ECB, while during normal times weekly main refinancing operations were considered the main policy instrument to provide liquidity to the banking sector, in order to respond to the negative economic conditions, the Central Bank has been acting along different dimensions. These recent ECB interventions included the following characteristics:

- **Maturity transformation -** ECB increased the maturities of repurchasing operations;

- **Liquidity transformation -** Illiquid assets were accepted as collateral for new asset purchases programs;
- **Transaction services -** ECB started to accept new counterparties as eligible;
- **Adverse selection -** Through new programs, the ECB absorbed the counterparties' credit risk.

Apart from these actions, other works consider the negative deposit facility rates to be part of the unconventional policies (Pereira, 2016). Nevertheless, for the purpose of this study, unconventional monetary measures will not be considered.

Although the theory advocates that unconventional operations work, this kind of monetary policies involves more uncertainty than conventional measures, regarding the economic impact of operations (Meier, 2009). Consequently, it is important to analyse its effects.

2.3 The Unconventional programs

In this section, the main ECB non-standard programs, whose impact on the stock markets is studied in this research, will be described.

Longer-term refinancing operations (LTROs)

Before the crisis, LTROs were conducted through competitive tenders in which each bank demanded an amount of liquidity and offered an interest rate to remunerate the Central Bank. Whilst the total amount of liquidity to be allotted was predetermined, only the highest interest rate bids were satisfied. In implementing the recent unconventional monetary policy measures, the ECB changed the scope of LTROs, which are now conducted with fixed rate tenders and full allotment procedure and have become the main source of funding for banks (Rivolta, 2014).

In August 2007, the ECB initiated its complementary liquidity measures through the announcement of the first supplementary LTRO, with three-month maturity. During March

2008, the Central Bank introduced 6-month maturity LTROs. Later on, in October 2008, it decided to increase the frequency and size of LTROs, as well as to adopt a fixed rate tender procedure with full allotment. Lastly, during December 2008, the Governing Council announced two LTROs with a three-year maturity and the option of early repayment after one year. The first was allotted in the end of December and the second in February of the following year.

Covered bond purchase programs (CBPPs)

Covered bonds are bonds issued by banks or credit institutions, which are collateralized against a group of assets. In the case of default of the issuer, covered bonds grant the holder the possibility of claiming that pool of assets. The covered bond market is the most important privately issued bond segment in Europe and is one of the main sources of banks' funding for mortgage lending (Rivolta, 2014).

With the beginning of the financial crisis, investors switched their preferences towards less risky assets, such as government bonds. Hence, in order to increase the liquidity in private debt security markets, banks' funding conditions and the risk profile of institutions holding covered bonds, the ECB had to take measures. On the 7 May 2009, the Governing Council announced that it would directly purchase 60 billion euros of euro-denominated covered bonds (with a minimum rating of AA or equivalent). The technical details of this first CBPP were publicized in June. Since the Eurozone had not recovered from the sovereign crisis at that time, on the 6 October 2011, the ECB announced that it would purchase 40 billion euros of euro-denominated covered bonds. The technical details of that measure were declared during the following month. Later, in September 2014, it was announced a third CBPP.

Securities Market Program (SMP)

Given the existence of severe malfunctions and liquidity shortages in some market segments, the ECB decided to purchase Euro-area marketable-debt instruments issued by central governments or public entities from distressed countries, with the objective of lowering the yields on sovereign bonds. On the 10 of May 2010, the Governing Council announced the first round of the program, which was only focused on Greek, Irish and Portuguese securities. Later, during August 2011, the ECB extended the program to include Italian and Spanish debt.

Outright Monetary Transactions (OMT)

Created to replace the aforementioned SMP program, the Outright Monetary Transactions program aims at diminishing the increases in tensions on sovereign bond markets. The program consists of purchasing government bonds with maturities of 1 to 3 years, provided that the country agrees to adopt specific economic measures. Thus, this program is meant for countries subject to the European Stability Mechanism Program. The official statement was that the OMT program was "aimed at safeguarding an appropriate monetary policy transmission and the singleness of the monetary policy." (European Central Bank, 2012).

The OMT program was announced in August 2012, with its details being published during September. However, the official announcement of the OMT was preceded by an important declaration by the President of the ECB, by the end of July 2012, which stated that "Within our mandate, the ECB is ready to do whatever it takes to preserve the euro. And believe me, it will be enough." (Rivolta, 2014).

Targeted longer-term refinancing operations (TLTROs)

In order to further incentivize bank lending to the real economy, the ECB introduced the targeted longer-term refinancing operations. TLTROs are operations that provide financing to credit institutions for periods of up to four years.

On the 5 June 2014, the Governing Council announced the first series of TLTROs. After that, other series have been announced. During March 2016, the ECB announced the so-called TLTRO II, in which the interest rate to be applied depended on the participating banks' lending patterns. "The more loans that participating banks issue to non-financial corporations and households (except loans to households for house purchases), the more attractive the interest rate on their TLTRO II borrowings becomes." (European Central Bank, 2017).

Asset Purchase Program (APP)

The Asset Purchase Program includes the purchase of private and public-sector securities, in order to address the risks of an excessively prolonged period of low inflation. This program expands the purchases of covered bonds and asset-backed securities, by including the so-called Public Sector securities, issued by central governments, agencies and European Institutions.

On the 22 January 2015, the ECB announced combined monthly purchases in public and private sector securities of 60 billion euros. Later, on the 3 December 2015, the Central Bank extended the program until March 2017. On the 10 March 2016, the Governing Council announced the decision to increase the monthly purchases to 80 billion euros.

2.4 Comparison of the Unconventional Monetary Policy of the ECB, Fed and the Bank of England

In order to respond to the financial crisis, the ECB, Fed and the Bank of England had to resort to unconventional measures that possessed some similarities. In simple terms, besides reducing the key interest rates, the central banks expanded existing facilities, provided liquidity to key credit markets and financial institutions, conducted asset purchases and resorted to forward guidance (Tuckwell & Mendonça, 2016).

Notwithstanding, there are considerable differences in the non-standard measures adopted by these banks. Firstly, it is relevant to contemplate that the ECB was trying to solve a sovereign debt crisis, while its American and English counterparties were facing a subprime banking crisis. Due to this, the ECB had to respond later than the other two central banks (Cour-Thimann & Winkler, 2013). Moreover, while the Federal Reserve worked on the American market-system and was oriented on non-banking credit markets and on operations involving private sector securities, the ECB was focused mainly on providing liquidity to banks. The Bank of England adopted mainly purchases of government bonds (Hálová, 2015).

Lastly, decision making is much more complex at the ECB. The European Central Bank has to deal with different Treasuries' sovereign debts and fiscal policies. Moreover, while the FED has two objectives, price stability and employment, the ECB only targets the latter, which limits the use of some unconventional tools.

In terms of results, the differences are clear. Besides being more timid at reducing interest rates, the ECB only later adopted serious quantitative easing measures. Therefore, especially in comparison to the Fed, the European Central Bank took more time to increase, in a considerable manner, its total assets' value, as it is seen in Figure 1 of the appendices.

3. Literature Review

Historically, both researchers and analysts have examined the effects of changes in monetary policy on stock markets. When considering the dividend discount model for equity valuation, it is possible to ascertain that there are two ways through which equity prices are affected by monetary policy. Firstly, monetary policy has a clear impact on interest rates, which consequently leads to changes in the discount rate for future cash flows. Secondly, as monetary policy can affect the short to medium term output, it may impact the expected cash flows themselves (Kontonikas & Kostakis, 2013). Furthermore, monetary policy influences the way

market agents perceive future economic conditions, thereby impacting their asset allocation decisions via the expectations channel (Falagiarda & Reitz, 2015).

This section reviews previous literature regarding the effects of conventional and unconventional monetary policy on equities and other assets. Moreover, there is a revision of the event study approach.

3.1 Previous literature on the effect of conventional monetary policy

The fundamentals in the study of the effects of monetary policy were brought by papers on the impact of standard policies, namely the effects of interest rate movements. However, as the efficient market hypothesis (Fama, 1965) predicts, stock prices only react to unexpected changes in monetary policy (Pearce & Roley, 1983). Both these authors also concluded that an unanticipated increase in the announced money supply depresses stock prices, while an unanticipated decrease elevates stock prices. Years later, Krueger & Kuttner (1996) concluded that month-to-month changes in the Federal funds rate are predictable, and the Fed funds futures market is very good at anticipating these changes. Thus, studies such as the ones of Bernanke & Kuttner (2015) started using a measure of monetary policy based on futures data, which clearly isolates the unanticipated element of policy actions. With this methodology, the authors reached similar conclusions: unexpected interest rate cuts lead to increases in stock prices. Later, other authors found that monetary policy actions in bear markets have a larger effect on stocks (Basistha & Kurov (2008); Laopodis (2010)).

Despite most literature focuses on the United States, several studies also examine the effects of unexpected ECB interest rate changes. Angeloni and Ehrmann (2003), Bohl et al. (2008), Hussain (2011) and Hayo & Niehof (2011) found evidence of an asymmetric stock market reaction to interest rate movements. In other words, European stock markets react negatively (positively), and significantly after an unanticipated raise (cut) of the interest rate directly

influenced by the ECB. Nonetheless, Fiordelisi et al. (2014) found that interest rate cuts did not produce a statistically significant effect on the stock markets between 2007 and 2012. During this period, the European interest rates reached the zero-lower bound and the ECB had to resort to unconventional measures. In analysing the effects of European interest rate changes, there were studies that came up with different methodologies so as to examine ECB's unexpected decisions. For instance, Filbien & Fabien (2011) defined unexpected movements by reviewing the consensus in specialized press throughout the days before the announcements.

Other previous literature also focuses on the effect of unexpected policy changes in different industries. In the United States, Ehrmann and Fratzscher (2004) and Bernanke & Kuttner (2005) found that cyclical sectors, such as technology, communications and consumer goods, react two to three times more to monetary policy than less cyclical sectors, such as energy and utilities. Nevertheless, this pattern may be different during a crisis (Kontonikas & Kostakis., 2013). In the case of the European market, Angeloni and Ehrmann (2003) and Kholodilin et al. (2009) found that equity prices of telecommunications, consumer goods, technology and financial companies seem the most sensitive to policy surprises, in an asymmetric way.

3.2 Previous literature on the effect of unconventional monetary policy

Apart from the effects of conventional monetary policy, many authors have been paying attention to the effects of non-standard policies, due to its recent extensive application by international central banks.

Swanson (2011) conducted a modern event study analysis of the 1960's Operation Twist and found that the program had a highly statistically significant impact on longer-term Treasury yields. More recently, Chodorow-Reich (2014) found that the introduction of Fed unconventional monetary policy in the winter of 2008–09 had a strong, beneficial impact on banks and, especially, on life insurance companies. In the same year, Rogers et. al (2014) found

that unconventional policies were effective in easing financial conditions when policy rates were stuck at the zero-lower bound, apparently by reducing term premia. In addition, the expansionary unconventional policies significantly raised stock prices in the US and in the Eurozone, but not in the UK or Japan.

In line with what happens in the study of the effects of conventional monetary policies, authors also apply different techniques to measure unexpected unconventional policies. In most procedures, researchers measure policy surprises by examining changes in asset prices. In their paper, Hosono and Isobe (2014) used the changes in daily prices of 10-year German government bond futures in order to measure European unconventional policy surprises. Nevertheless, as several unconventional measures applied by the ECB, during the crisis, targeted the lowering of sovereign spreads in peripheral countries, it might not make sense to measure monetary surprises using only German yields. In this sense, Rogers et al. (2014) used the yield spread between German and Italian 10-year government bonds at the day of an ECB announcement in order to measure unconventional monetary surprises.

At first, most studies related to the impact of ECB's non-standard policies focused on the effects on Government bond yields. During a premature phase of the introduction of these measures, Schaeck & Cihak (2009) found evidence that the lengthening of the maturity of monetary policy operations and the provision of funds at the fixed rate had some beneficial effects on government bond term spreads. Krishnamurthy et al. (2014) conducted an event study to estimate the effects of the SMP, OMT and LTRO programs on yields of distressed sovereign bonds in the Eurozone, and found dramatic decreases in yields for all countries around SMP and OMT announcement dates. For the LTRO program, the authors found no significant effect for peripheral countries. In a similar manner, Falagiarda & Reitz (2015) concluded that ECB unconventional policies' announcements substantially reduced long-term government yields of

the GIIPS countries, except for Greece. Furthermore, the authors also concluded that ECB news have not been subject to anticipation nor delayed effects.

Nonetheless, more recently, some authors have analysed the effects of ECB's unconventional policies on stock markets. Fratzscher et al. (2014) reported similar findings to the ones of Rogers et al. (2014), and stated that liquidity injections via Supplementary LTROs, the OMT and the SMP positively affected equity prices (both broad and banking equity indices) in the "core" and the "periphery" of the Eurozone. Particularly, the OMT and the SMP programs had positive spillovers to equity prices, worldwide. Haitsma et al. (2015) reached the conclusion that unconventional monetary policy surprises had stronger effects on the EURO STOXX 50 index than standard policy surprises. However, not all authors reported positive effects of unconventional policies in the euro area. For instance, Hosono & Isobe (2014) concluded that European stock markets reacted negatively to ECB's unconventional policies, arguing that expansionary policies during a crisis might signalize that economic conditions are worse than market agents realized.

Regarding the impact of ECB's non-standard measures on European industries, most authors have analysed its effects on banks, given their financing importance in the euro area. On a paper focused on the effects of the OMT program, Acharya et. al (2015) reported that the OMT announcement indirectly recapitalized periphery countries' banks by increasing the value of their sovereign bonds. Ricci (2015) arrived to results that suggested that banks were more sensitive to nonconventional measures than to interest rate decisions. In a more general study, Haitsma et al (2015) also found that the banking sector benefited the most from unconventional policies' announcements, followed by the insurance and oil & gas sectors. Moreover, unconventional measures had more positive effects on industries producing durable goods than on non-durable sectors.

3.3 The Event study applications and criticisms

There are several methodologies that can be used in order to study the effects of unconventional monetary policies. Some studies analyse the impact of monetary policy on stock markets using vector autoregressive models (Mojon & Peersman, 2001; Angeloni et al., 2003; Laopodis, 2010; Cihak et al., 2009; Kontonikas & Kostakis, 2013) or GARCH models (Aijo et al., 2006). Nonetheless, most research applies the event study methodology, which was introduced by Fama et al (1969). Nowadays, event-studies are conducted in order to determine whether a particular event in the capital market or in the life of a company had an impact on a company's stock performance.

Nevertheless, there are different ways to conduct event-studies in this line of research. While studying the impact of Quantitative Easing announcements in the US, Chodorow-Reich (2014) uses a cross-sectional approach, regressing event window return of companies on a constant. Krishnamurthy et al. (2014) criticized this methodology, stating that it rested on the assumption that the common component was entirely caused by the event. In fact, most event studies take into account periods outside the event window and compare them with the event period. Researchers calculate normal and abnormal returns to identify event specific effects on assets. Nevertheless, when the event is the same for different securities, one has total clustering of observations. When this happens, papers such as the ones of Binder (1985) or MacKinlay (1997) suggest the use of a multivariate regression model, which uses dummy variables for events. In this line of procedure, Krishnamurthy et al. (2014) and Ricci (2015) applied models with dummies that take the value of one on the days of the monetary announcements.

Henderson (1989) or Brown & Warner (1985) found that there is no significant difference between event study models' results: even the simplest versions of the event study design work.

Campbell et al. (1997) explains that this is because of the fact that the variance of abnormal returns is not much reduced by the choice of a more sophisticated model.

Nonetheless, there are criticisms regarding the event study approach. The disapprovals are based on the fact that related papers assume that the surprise part of the announcements or the monetary policy shocks are captured by some ad hoc window size around the chosen event. Rigobon & Sack (2004) state that if this assumption does not hold, the method is proven to be biased. If the window is too narrow, it may miss part of the effects of the announcement. If it is too wide, it may contaminate the monetary surprise with other news. Bearing this in mind, Bohl et al. (2008) and Rogers et al. (2014) used the heteroscedasticity-based method of Rigobon & Sack in their papers. Within this technique, the response of asset prices to changes in monetary policy can be identified based on the increase in the variance of policy shocks that occurs on announcement days. This identification approach requires a much weaker set of assumptions than needed under the event study approach (Rigobon & Sack, 2004).

Later, Rosa (2011) found that the event study estimates contain a significant bias. However, the same author argued that this bias is fairly small and that the OLS approach tends to outperform, in an expected squared error sense, the heteroscedasticity-based estimator, for both small and large sample sizes. Hence, in general, the event study methodology should be preferred.

4. Research Hypothesis

Given the recent literature on the effects of unconventional monetary policies in the Eurozone, this paper tests 3 hypothesis regarding the impact of the aforementioned policies in the European stock markets, at a country and industry levels. These hypotheses are described below:

Hypothesis 1: unconventional monetary policies' announcements have significant impacts on European stock markets.

Hypothesis 2: the announcements have different effects on the various countries and industries' stock indices.

Hypothesis 3: stock prices adjust to the announcement of unconventional policies during the event day.

In order to test the research hypotheses, an event study based on three different models will be conducted. The next section refers to a description of the data and methodology.

5. Data and Methodology

5.1 Data

In order to conduct this paper, daily price data for European domestic and industry stock indices were considered. At a national level, twelve countries, belonging to the euro area, were chosen, as it can be seen in Table 1 of the appendixes. Although Slovenia, Cyprus, Malta, Slovakia, Estonia, Lithuania and Latvia also belong to the Eurozone, these nations were excluded from the report due to their late entrance. At an industry level, the nineteen "supersectors" were used, as defined by the International Classification Benchmark and as is shown in Table 2 of the appendixes. All companies belonging to these nineteen indices are from the euro area countries, as well. Additionally, the MSCI EMU index was used as a broad-based market index[1]. Furthermore, German and Italian 10-year Government bond yields were used, in order to measure unexpected unconventional policies. All of the aforementioned data was extracted

[1] The MSCI MEU index is a Morgan Stanley Capital Internatinal (MSCI) free float-adjusted market capitalization weighted index, which measures the equity market performance of 10 euro area countries (MSCI, 2017).

from Bloomberg, except for the MSCI EMU index returns, which were retrieved from Datastream.

The continuously compounded returns were calculated as: $r_{it} = \ln(\frac{P_t}{P_{t-1}})$. In this equation, the numerator is the stock closing price at the end of day t, and the denominator is the stock closing price at the end of the previous day (t-1).

Tables 1 and 2 of the appendices display the descriptive statistics of national and industry stock market indices, at a time period starting on the 3 January 2007 and ending on the 31 December 2016. During this period, the euro area faced an economic crisis that had serious consequences for equity markets. Therefore, it is not surprising to see that most of the domestic stock indices had negative mean daily returns. While the German stock index had the largest mean daily returns, the Greek and Portuguese indices performed the worse, on average. Greece and Italy displayed the most volatile returns, as it can be seen by their standard deviation. The economic crisis had its strongest effects on the banking industry, which, consequently, had the lowest mean daily returns. Contrarily, non-durable sectors are among the best performers, as it can be seen for Personal & Household goods, Chemicals and Food & Beverages industries. The Automobile & Parts and the Banking indices were the most volatile. As it was predicted, due to the inherent characteristics of daily stock returns, the results of skewness-kurtosis tests indicate a strong degree of non-normality.

Defining the date in which the market first learns of the new information is a crucial task in every event study. Omitting potentially relevant event dates not only reduces the power of the test, but can also introduce downward and upward biases. In this paper, previous event studies of the effects of ECB unconventional monetary policy were looked up, in order to set the event dates. Specifically, the works of Kilponen et al. (2012), Rogers et al. (2014), Pereira (2016),

Ambler & Rumler (2016), Galariotis et al. (2017) and Jager & Grigoriadis (2017) were examined. After a detailed analysis of the events' importance, as it is described in the above-mentioned papers, a group of announcements that were part of six main ECB unconventional programs were chosen. Table 3 of the appendixes describes them in detail.

5.2 Methodology

Traditionally, event-studies share common phases. First, investigators define the date upon which the market received the news. After that, they characterize the returns of the individual companies in the absence of this news (normal returns) and measure the difference between observed returns and "no-news" returns for each firm (abnormal returns) during the event window. After aggregating abnormal returns across firms and time, they statistically test their significance (Henderson, 1990).

However, when the event is the same for different securities, one has total clustering of observations. In other words, the residuals will not be independent if the event occurs during the same calendar time period for some firms. When this happens, papers such as the ones of Binder (1985) or MacKinlay (1997) suggest the use of a multivariate regression model, which uses dummy variables for events. Given that the events naturally occur at the same time for each domestic and industry stock indices, I follow the approach suggested by Krishnamurthy & al. (2014) and Ambler & Rumler (2016) and use a time-series dummy variable regression, in order to study the effects of unconventional monetary policy announcements on the European stock markets. The equation, which is applied to each stock index returns from 2007 to 2016, using the Ordinary Least Squares (OLS) method, is the following:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \gamma_{i1} LTRO_t + \gamma_{i2} CBPP_t + \gamma_{i3} SMP_t + \gamma_{i4} OMT_t + \gamma_{i5} TLTRO_t + \gamma_{i6} APP_t + \varepsilon_{it} \quad (1)$$

In this model, R_{it} represents the returns on day t of a certain stock index i, α_i is the constant, β_i is the variable that measures the influence of market returns (R_{mt}) and ε_{it} is the error term on day t. Most importantly, the regression includes dummy variables for each of the six analysed ECB unconventional programs, with the various announcements divided between them. Since the event window includes just the day of the announcement, the dummy variables take the value of 1, on the event day, and 0, if not. Although other studies use models with dummy variables for single announcements, I decided not to do so, as using singleton dummies – dummy variables with only one observation – is not only computationally inefficient, but also overstates the statistical significance of the regression coefficients and might lead to incorrect inference (Correia, 2015).

Due to the characteristics of daily data, there might be some problems with the OLS time series approach. While non-normality of daily returns is not relevant for significance tests, in event study methodologies (Brown and Warner, 1985), the presence of heteroscedasticity and autocorrelation leads OLS to no longer be the best linear unbiased estimator (BLUE). Therefore, I conducted some formal tests in order to detect these characteristics in the model, beginning by conducting both White and Breusch-Pagan tests for heteroscedasticity using the Stata software. As it can be seen in Figure 3 of the appendices, for the French index returns, the null hypothesis of homoscedasticity is clearly rejected. Afterwards, I analyse the autocorrelation function plot for the dependent variable. As it can be seen in Figure 4 of the appendices, the null of no autocorrelation with 5 lags is clearly rejected. Since I obtained similar test results using Stata for the other stock returns, from both national and industry indices, I assume the model to suffer from heteroscedasticity and autocorrelation of 5 lags. Consequently, in order to adjust the covariance matrix for heteroscedasticity and autocorrelation, I decided to follow the methodology applied by Ioannidis & Kontonikas (2008) and use Newey-West standard errors with 5 lags. This methodology is not only used in all of this paper's regressions,

but is also applied to panel data analysis of the effects of ECB's unconventional policies on groups of countries, such as the GIIPS.

When considering the characteristics of the announcements under study, it may be concluded that many of them were extensions or changes in the conditions of some programs. As a result, I believe that some of those events were not meaningful for the European equity markets, hence being negligible for the common investor. For the purpose of finding the announcements that were significant enough to affect the stock markets, I follow the approach of Galariotis et al. (2017) and specify which of these ECB announcements were covered by Financial Times' headline articles, as it is shown in Table 3 of the appendices. Moreover, I use the following equation in order to study the effects of these important events:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \gamma_{i1} IMP\_ANN_t + \varepsilon_{it} \quad (2)$$

The independent variable IMP_ANN_t is a dummy that takes the value of 1, on the days of "Important Announcements"[2]. While the event that happened on the 8 August 2011 was covered by a Financial Times' headline article, I decided not to include it on the group of "Important Announcements", since, US and global stock markets crashed after Standard & Poors downgraded US sovereign debt from an AAA credit rating to AA+ on the previous Friday Night (Financial Times , 2011). Given the magnitude of this happening, I am sure that it contaminated the effects of the ECB announcement, and thus it is not possible to accurately examine its effects on European stocks.

Following Falagiarda & Reitz (2015), I also decided to look for anticipation and delayed effects. Therefore, using regression (2), I include a dummy variable, which takes the value of 1 during

[2] The "Important Announcements" group includes the following dates: 22/08/2007; 07/05/2009; 10/05/2010; 06/10/2011; 26/07/2012; 06/09/2012; 05/06/2014; 04/09/2014; 22/01/2015 and 10/03/2016

the event day and the previous one, and another dummy variable, which takes the value of 1 during the event day and the following one.

The previously presented regressions do not incorporate a measure of the unexpected part of the ECB announcements. In the light of this fact, I decided to conduct another regression, which follows the methodology of Rogers et al. (2014) and Haitsma et al. (2016). These authors used the yield spread between German and Italian 10-year government bonds at the day of an ECB announcement, in order to measure unconventional monetary surprises. The surprise factor can be represented as:

$$\Delta r_t^{u,c} = (y_{s,t}^I - y_{s,t}^G) \text{-} (y_{s,t-1}^I - y_{s,t-1}^G)$$

In this model, $y_{s,t}^I$ and $y_{s,t}^G$ are the Italian and German 10-year government bond yields at day t respectively.

Consequently, the following equation measures the effects on European stock markets of the change in spread between German and Italian 10-year bond yields during the days of "Important Announcements":

$$R_{it} = \alpha_i + \beta_i R_{mt} + \gamma_{i1} \Delta r_t^{u,c} + \varepsilon_{it} \quad (3)$$

6. Results

During this section, I will present the results obtained for the various models, for both national and sectorial indices. The interpretation of these results will confirm or negate my hypotheses.

6.1 Country results

Table 4 of the appendices shows the results for equation (1), when applied for the different domestic indices. As expected, the MSCI EMU index is highly significant for all countries' indices.

In terms of the effects of the LTRO program, the panel-data results display an insignificant impact for all indices, except for the German one. The LTROs were designed to improve banks' liquidity positions, further reducing term spreads in the money market, while encouraging banks to maintain and increase their provision of credit to the real economy (European Central Bank , 2012). However, Daetz et al. (2016) concluded that the excess liquidity generated by means of this operation apparently was absorbed by the deposit facility on a daily basis. Hence, this measure was not enough to boost corporate investments. Given these findings, it can be suggested that this program was also inefficient at boosting investors' confidence, and stock prices as a result. Nonetheless, regarding the results for the German index, these suggest that German equities did not react well to the first news that indicated that the ECB had to take serious initiatives in order to attenuate the effects of the European Crisis.

The results for the CBBP program also indicate that these measures mostly had an insignificant influence on the European stock markets. This program targeted the rehabilitation of the private debt security markets, and thus it might not have caused significant effects on equities.

The results for the SMP announcements indicate significant effects on European stock markets, for both the northern and peripheral countries. However, the signs are different for both groups. On one hand, for the IPS group, an SMP announcement produces an increase of almost 2% in abnormal returns. On the other, for the northern countries, an SMP announcement causes a decrease of 1% in abnormal returns. These conclusions are in accordance with the findings of Krishnamurthy et al. (2014) who find strong stock price reactions for the SMP program. These authors also found that the SMP worked mainly through a reduction in default and redenomination risk, which positively affected investors' confidence in the peripheral countries. Contrarily, for the northern countries, the SMP measures create moral hazard problems, since these countries would have to bailout the southern economies. Moreover, these

policies diminished the need for fiscal discipline in the European periphery and could lead to rising inflation levels in the northern nations.

Table 4 of the appendices displays mostly insignificant coefficients for the OMT program. According to Krishnamurhty et al. (2014), the OMT program had similar results to the SMP, also working mainly through a reduction in default and redenomination risk. However, the insignificant impacts on stock markets might be explained by some particular reasons. While on one hand, the OMT is "intended to prevent market panic from pushing otherwise solvent governments into bad equilibria", on the other the program conditionally "requires more austerity" (The Bruegel Newsletter, 2014). These two consequences, which theoretically would cause contrasting effects, might have cancelled the effects of one another.

The results of Table 4 of the appendices suggests that the TLTRO program had an insignificant impact on European stock indices. The TLTRO program was created to eliminate the flaws of regular LTROs. Since the permitted additional borrowing amounts would be linked to the banks' lending to the non-financial sector, TLTROS were more directed towards their final goal of overcoming the financing difficulties at the corporate and household levels (Daetz et al., 2016). However, some investigators concluded that "the program had not managed to put us back to a high growth path of lending to the real economy" (The Bruegel Newsletter, 2016). Additionally, it was also appointed that markets were sceptic towards the effectiveness of the measures announced (Seeking Alpha, 2016), which might explain the negative signs of the (insignificant) coefficients.

In relation to the APP program, the results suggest significant effects on the stock markets. The signs of the coefficients indicate that the program benefited the GIIPS countries' indices, but harmed some of the northern ones. The APP is considered the ECB experience with Quantitative Easing. As it is shown on figure 1 of the appendices, these measures significantly

raised the European Central Bank's assets. For periphery countries, the program proved that the ECB was ready to do "whatever it takes" to save the Euro area, which clearly improved confidence. For the northern countries, such as Germany, the APP announcements indicated that these more robust economies would have to step-in in order to "bailout for free-spending governments such as Greece" (The Guardian, 2015).

Besides looking at the programs at an individual level, it is fundamental to evaluate the impacts of the overall unconventional announcements, taking into account the events that were more meaningful for investors. In order to do so, we analyse the results for the second regression, which takes into account the "Important Announcements".

As can be seen in Table 5 of the appendices, the results for equation (2) indicate statistically significant and positive abnormal returns for the Italian, Portuguese and Spanish indices. For the IPS group, an important ECB unconventional announcement causes on average a close to 1% increase in abnormal stock returns. However, the contrary happens for the German case. The ECB non-standard measures could lead to inflation pressures for Germany, besides indicating that this country would have to "step-in" and share the risk with the ECB, in order to attenuate the effects of the European crisis on the less fiscally prudent countries of the Euro system. The statistically non-significant coefficient for Greece confirms the idea that the Greek financial crisis developed in an independent way from the rest of Europe (Gonzalez-Hermosillo & Johnson, 2014). In terms of the Irish index, it might have reacted in a negative way to ECB's non-standard measures since the country introduced austerity measures first than the other GIIPS, and "also benefited with the recovery of its two biggest export markets, Britain and United States. A weaker euro also helped" (Foreign Policy, 2016).

Additionally, the results displayed in Table 5 of the appendices indicate that there were no anticipation nor delayed effect, which is in accordance with Falagiarda & Reitz (2015).

Finally, as seen in Table 6 of the appendices, the results for equation (3) show evidence of a highly significant negative influence of the unconventional monetary policy surprise for the IPS countries. An unconventional monetary policy announcement that causes a decrease in the German-Italian yield spread of 0,18% points (the average change on event days) produces on average an increase of 0,6% in the abnormal stock returns of the IPS countries. Unsurprisingly, the coefficients' values have positive signs for most northern countries' indices. For these, a decrease in the German-Italian yield spread is related to a decrease in abnormal returns. The results are qualitatively in accordance with the findings of Haitsma et al. (2015) and Rogers et al. (2014).

6.2 Industry results

Table 7 of the appendices shows the results for equation (1) applied to industry stock returns. The analyses of the programs' impacts shows mostly negligent effects for the LTRO, CBPP and TLTRO dummies. In relation to the SMP program, it seems that it highly benefited banks' stock returns. Other positive effects are found for the Insurance and Telecommunications sector. Contrarily, the SMP mostly provoked negative effects on the stock returns of non-durable industries, such as the Basic Resources and Chemicals. As for the case of the OMT, the results are difficult to interpret, given the heterogeneity of the relationships between the coefficient signals and the sectors' characteristics. Lastly, the APP program results provide evidence for positive effects on the banking stocks (albeit at the 10% level). Nevertheless, for the same program, we can find evidence for negative and positive impact on different durable and non-durable industries, which prejudices the making of inferences for the impacts of the APP.

Given the previous conclusions, it might be better to focus on the results of equation (2), which are found on Table 8 of the appendices. For this model, the results suggest that ECB's unconventional monetary policies had significant and positive effects on the banking sector. On

average, an unconventional monetary policy announcement leads to a 1% increase in abnormal stock returns for European banks. It is unsurprising to see that this is the sector that benefited the most from ECB's unconventional policies' announcements. On one side, these measures significantly reduced bank risk and allowed banks to access market based financing again. On another, ECB non-standard policies substantially reduced the yields on periphery sovereign debt, which directly effects financial companies' balance sheets. After Banks, the Real Estate, Insurance and Telecommunications sectors also show positive and significant coefficients, at a 10% level. The first benefited with the improved credit conditions at a corporate and household level. The second benefited from the rising value of legacy assets (Chodorow-Reich, 2014). In contrast non-durable sectors, like Chemicals, Technology or Personal & Household goods, which are less dependent on economic and financing conditions, from a customer demand perspective, have negative coefficients, meaning that ECB's unconventional polices are related with negative abnormal returns. These results are qualitatively in line with the findings of previous authors, such as Haitsma et al. (2015).

In terms of anticipation and delayed effects, the results provide no evidence of their existence.

Moreover, the results for equation (3), found on Table 9 of the appendices, which takes into account the measure of unconventional policy surprises, confirm that the ECB non-standard announcements were advantageous for the banking sector's stocks. An unconventional monetary policy announcement that causes a decrease in the German-Italian yield spread of 0,18% points (the average change on event days) produces on average an increase in the abnormal returns of European banks' of more than 1%. Additionally, it seems that the Insurance and the Telecommunications sectors' stocks were also benefited by non-standard monetary policies. Regarding the Telecommunications sector, these results can be explained by the high external finance dependence of this industry, which consequently benefits from better credit

conditions. Lastly, the coefficients for most non-durable sectors indicate that stock returns react symmetrically to decreases in the German-Italian Government bond yield spread.

As a conclusion, I would like to point out that this paper's results agree with the three hypotheses that were previously outlined.

7. Conclusion

The main objective of this paper was to study the effects of the ECB's unconventional policies on European stock returns, since most of the previous research had focused on the impact on other assets, especially on Government bonds.

Through a methodology that is built on the approach of previous authors, I conducted an event study that provides evidence for the existence of statistically significant impacts of unconventional policy on the stocks of both countries and industries' stock indices. My event study combines the results of three different models. First, I start by following the approach used by Krishnamurthy et al. (2014) and use a time-series dummy variable regression that includes dummies for six ECB unconventional programs (LTRO, CBPP, SMP, OMT, TLTRO and APP). Since the econometric tests indicate the presence of heteroscedasticity and autocorrelation, I adjust my model with the use of a Newey-West estimation of standard errors, as it was suggested by Ioannidis & Kontonikas (2008).

An examination of the nature of the announcements suggests that some were not considered important news for investors. Therefore, in order to specify which ones had enough magnitude to change investors' confidence, I follow the approach of Galariotis et al. (2017) and identify which of these ECB announcements were covered by Financial Times' headline articles. After that, I specify a time-series regression that only takes into account those events.

My methodology ends with the study of the relationship between stock returns and changes in the yield spread between German and Italian 10-year government bonds during announcement dates. This approach was firstly suggested by Rogers et al. (2014).

At a country level, the results suggest that the SMP and APP programs had a significant influence on the stock markets of various European nations. First, the SMP announcements led to positive abnormal returns in the IPS group's indices, but negative abnormal returns for the northern countries. Second, the APP program benefited the GIIPS countries' indices, but harmed some of the northern ones, such as the German. Regarding the other four programs, the results do not provide evidence for significant impact on abnormal stock returns of European indices.

If we consider the effects of the announcements covered by Financial Times' headline articles, the results indicate that ECB unconventional policies benefited the peripheral European stock markets, namely Italy, Spain and Portugal. This is in line with the effects of unconventional measures on government bonds' yields for these countries, as observed in previous papers. Stock market effects are negative for Germany, though. For this country, the ECB non-standard measures might lead to raising inflation levels, and also create moral hazard problems, since Germany would have to "bailout" the peripheral economies, which had followed fiscally imprudent policies.

In relation to the results of the third model, these suggest the existence of a significant and negative relationship between abnormal stock returns and changes in the yield spread between German and Italian bonds for the IPS nations. The contrary happens for countries such as Germany and Finland.

In terms of the effects across industries, the study finds mostly insignificant effects for the LTRO, CBPP, OMT and TLTRO programs. Moreover, the results provide statistical evidence

of positive impacts of the SMP and APP programs on banking stocks, albeit the latter at the 10% level.

If we consider only the "Important Announcements", results are easier to interpret. As it was expected, the banking sector benefited the most with the ECB's unconventional polices, followed by the Real Estate, Telecommunications and Insurance sectors. In contrast, the coefficient results are negative for the case of non-durable sectors, like Chemicals, Technology or Personal & Household goods. The results for equation 3 are in accordance with the previous findings.

Finally, it is important to describe how future related research can proceed. First, investigators could focus on describing the reasons for some events being more important than others. An analysis of the event collection of previous literature shows no consensus in this matter. Second, besides the event study approach, other methodologies such as the identification through the heteroscedasticity-based approach of Rigobon & Sack (2004) could be applied. Third, investigators could study the effects of unconventional policies on companies based on their different characteristics, such as size, cash levels or financial leverage. Forth, it could be studied the effects of ECB's unconventional policies on stock indices that do not incorporate financial companies. Finally, other works could focus on studying the prolonged effects of unconventional policies, instead of analyzing the effects around the announcement dates.

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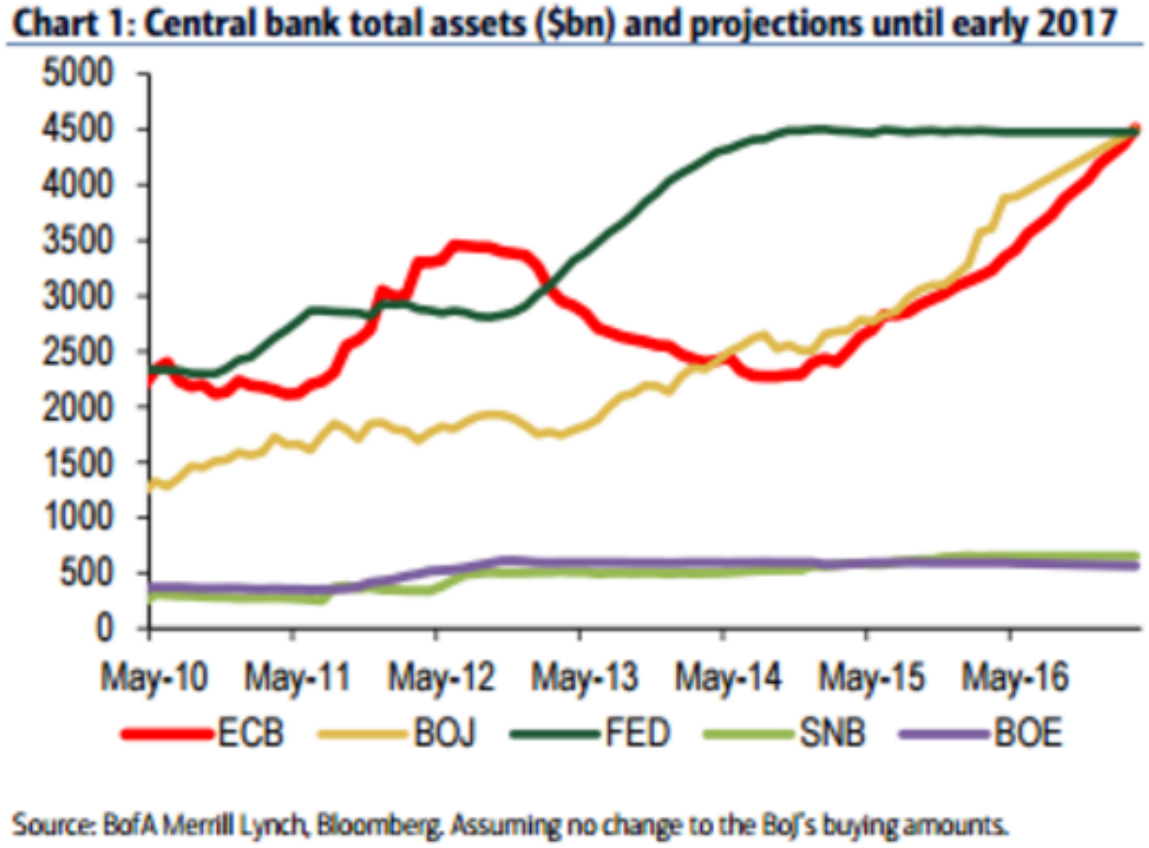
9. Appendices

Figure 1



Source: BofA Merrill Lynch, Bloomberg. Assuming no change to the BoJ's buying amounts.

Table 1: Descriptive statistics of countries' daily stock market data

	Mean	Std. Dev.	Min	Max	Normality (Sk/Kur)[3]
Austria	-0,02%	1,72%	10,25%	12,02%	0,00
Belgium	-0,00%	1,34%	-8,32%	9,22%	0,00
Finland	-0,00%	1,479%	-8,160%	8,850%	0,00
France	-0,01%	1,527%	-9,472%	10,595%	0,00
Germany	0,02%	1,470%	-7,430%	10,800%	0,00
Greece	-0,08%	2,240%	17,713%	13,431%	0,00
Ireland	-0,02%	1,621%	13,964%	9,733%	0,00
Italy	-0,03%	1,754%	13,331%	10,874%	0,00
Luxembourg	-0,01%	1,450%	11,159%	9,104%	0,00
Netherlands	-0,00%	1,431%	-9,590%	10,028%	0,00
Portugal	-0,03%	1,387%	10,379%	10,196%	0,00
Spain	-0,02%	1,638%	13,185%	13,484%	0,00

Table 2: Descriptive statistics of industries' daily stock market data

	Mean	Std. Dev.	Min	Max	Normality (Sk/Kur)
Automobile & Parts	0,023%	2,366%	-35,730%	41,081%	0,00
Banks	-0,052%	2,305%	-19,874%	17,763%	0,00
Basic Resources	-0,022%	2,256%	-13,889%	15,966%	0,00
Chemicals	0,027%	1,539%	-8,604%	12,555%	0,00
Construction & Materials	-0,003%	1,809%	-10,700%	12,376%	0,00
Financial Services	-0,013%	1,608%	-10,390%	12,247%	0,00
Food & Beverages	0,023%	1,194%	-6,893%	6,600%	0,00
Healthcare	0,017%	1,288%	-8,715%	9,672%	0,00
Industrial Goods & Services	0,014%	1,598%	-10,360%	11,574%	0,00
Insurance	-0,009%	1,978%	-11,134%	13,582%	0,00
Media	-0,003%	1,255%	-8,040%	11,342%	0,00
Oil & Gas	-0,012%	1,690%	-10,121%	13,084%	0,00
Personal & Household goods	0,028%	1,392%	-7,416%	9,196%	0,00
Real Estate	-0,012%	1,550%	-8,635%	8,780%	0,00
Retail	0,014%	1,327%	-8,740%	7,674%	0,00
Technology	0,011%	1,534%	-10,706%	9,652%	0,00
Travel & Leisure	0,008%	1,468%	-9,190%	7,640%	0,00
Telecommunications	-0,013%	1,383%	-9,969%	10,471%	0,00
Utilities	-0,029%	1,500%	-9,003%	15,673%	0,00

[3] This refers to a Skewness Kurtosis test for normality, which is similar to a Jarque Bera test of normality. It shows probability<chi2

Table 3: ECB Unconventional Monetary Policy Events

Unconventional Program	Date	Description	Financial Times Headline Article[4]
LTRO	22/08/2007	Announcement of the first supplementary LTRO (3 month maturity, standard tender and allotment procedure)	Yes
LTRO	28/03/2008	Announcement of 6 month LTROs and continuation of the supplementary 3 month LTROs	No
LTRO	15/10/2008	Announcement of several LTROs (3 and 6 month maturity, fixed-rate and full allotment procedure)	No
LTRO	08/12/2011	Announcement of two LTROs with 3 years maturity	No
LTRO	21/12/2011	First allotment date for the 3 years maturity LTROs	No
LTRO	29/02/2012	Second allotment date for the 3 years maturity LTROs	No
CBPP	07/05/2009	Announcement of the purchase of euro-denominated covered bonds issued in the euro area (CBPP1)	Yes
CBPP	04/06/2009	Publication of the technical details of CBPP1	No
CBPP	06/10/2011	Announcement of the second Covered Bond Purchase Program (CBPP2)[5]	Yes
CBPP	03/11/2011	Publication of the technical details of CBPP2	No
CBPP	04/09/2014	Announcement of a new Covered Bond Purchase Program (CBPP3) and a new Asset Backed Securities Program	Yes
SMP	10/05/2010	Announcement of the Securities Markets Program	Yes
SMP	08/08/2011	Announcement of the re-launch of the SMP	Yes
OMT	26/07/2012	Draghi states that the ECB is ready to do "whatever it takes" to preserve the euro	Yes
OMT	02/08/2012	Press conference announcing Outright Monetary Transactions	No
OMT	06/09/2012	Publication of technical details of OMT	Yes

4 Sources can be found in the references

[5] During this day, the ECB also announced two LTROs with 12-month maturity. However, in order to avoid multicolinearity problems with the programs dummy variables, I decided to include this event date only in the CBPP group.

TLTRO	05/06/2014	ECB announces a first series of TLTROs and decides to cut the deposit facility rate below zero for the first time.	Yes
TLTRO	16/09/2014	Announcement of the first TLTROs.	No
TLTRO	09/12/2014	Announcement of the second TLTROs.	No
TLTRO	17/03/2015	Announcement of the third TLTROs.	No
TLTRO	16/06/2015	Announcement of the fourth TLTROs.	No
TLTRO	22/09/2015	Announcement of the fifth TLTROs.	No
TLTRO	09/12/2015	Announcement of the sixth TLTROs.	No
TLTRO	22/03/2016	Announcement of the seventh TLTROs.	No
APP	22/01/2015	Announcement of a large-scale Asset Purchase Program.	Yes
APP	03/12/2015	Announcement of an extension of the APP.	No
APP	10/03/2016	Announcement of a further refinement of the APP, which includes the Corporate Sector Purchase Program[6].	Yes

Figure 2: Equation (1) outputs for the French stock index, without robust standard errors

```
. reg IndexReturn LTRO CBPP SMP OMT TLRO APP MSCIEMU
```

Source	SS	df	MS		
Model	.58052099	7	.08293157	Number of obs	= 2,560
Residual	.016418381	2,552	6.4335e-06	F(7, 2552)	= 12890.51
				Prob > F	= 0.0000
Total	.596939371	2,559	.000233271	R-squared	= 0.9725
				Adj R-squared	= 0.9724
				Root MSE	= .00254

IndexReturn	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
LTRO	-.0007096	.0010379	-0.68	0.494	-.0027447	.0013256
CBPP	.0006886	.0011363	0.61	0.545	-.0015395	.0029167
SMP	-.00557	.0017966	-3.10	0.002	-.009093	-.002047
OMT	-.0007083	.0014661	-0.48	0.629	-.0035833	.0021666
TLRO	.0004342	.0008986	0.48	0.629	-.0013279	.0021963
APP	-.0013919	.0014658	-0.95	0.342	-.0042661	.0014824
MSCIEMU	1.030666	.0034458	299.11	0.000	1.023909	1.037423
_cons	-.0001058	.0000504	-2.10	0.036	-.0002047	-7.01e-06

[6] During this day, the ECB also announced a new series of TLTROs. However, in order to avoid multicolinearity problems with the programs dummy variables, I decided to include this event date only in the APP group.

Figure 3: The Breusch-Pagan and White tests for heteroscedasticity in equation (1) (French stock index example)

```
. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of IndexReturn

         chi2(1)      =    11.68
         Prob > chi2  =   0.0006

.
. estat imtest

Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p
Heteroskedasticity	105.17	14	0.0000
Skewness	12.56	7	0.0836
Kurtosis	4.03	1	0.0446
Total	121.77	22	0.0000

Figure 4: Autocorrelation plot of squared residuals (French stock index example)

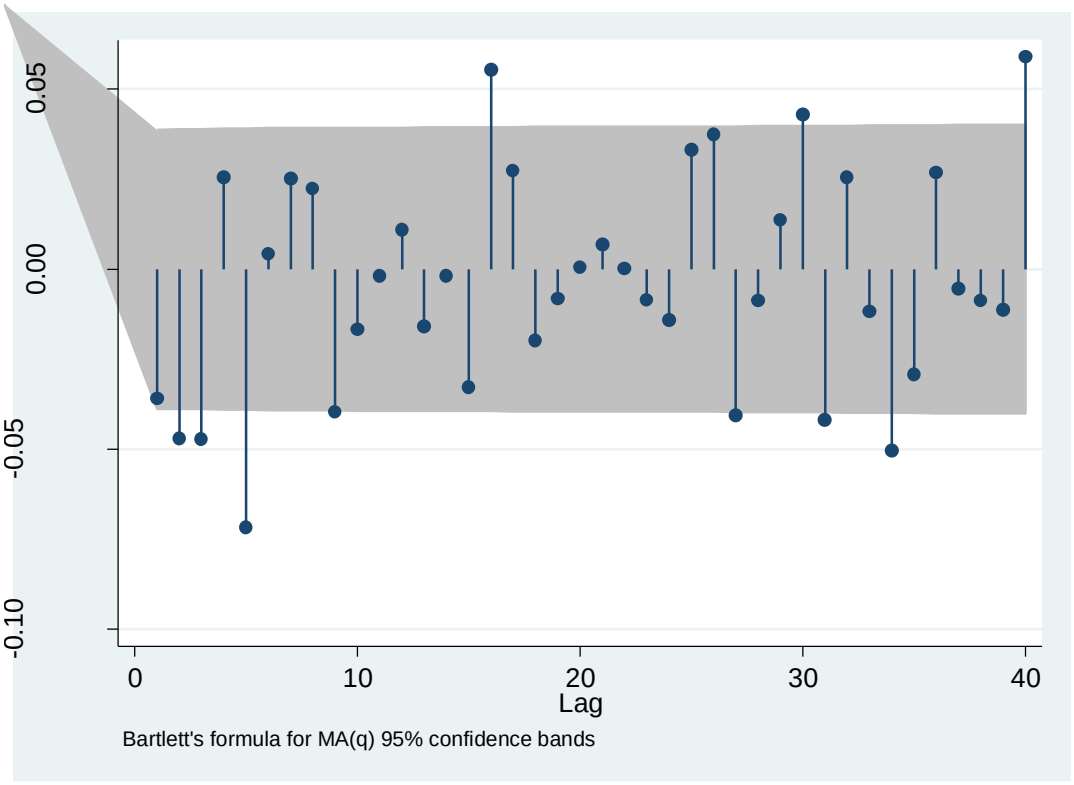


Figure 5: Equation (1) outputs for the French stock index, with Newey-West standard errors with 5 lags

```
. newey IndexReturn LTRO CBPP SMP OMT TLRO APP MSCIEMU, lag(5)

Regression with Newey-West standard errors      Number of obs     =      2,560
maximum lag: 5                                  F(  7,      2552) =    7845.99
                                                Prob > F          =    0.0000
```

IndexReturn	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
LTRO	-.0007096	.001205	-0.59	0.556	-.0030725	.0016534
CBPP	.0006886	.0003309	2.08	0.038	.0000397	.0013375
SMP	-.00557	.0005538	-10.06	0.000	-.0066559	-.004484
OMT	-.0007083	.0010285	-0.69	0.491	-.0027251	.0013084
TLRO	.0004342	.0006504	0.67	0.504	-.0008411	.0017096
APP	-.0013919	.0002407	-5.78	0.000	-.0018638	-.0009199
MSCIEMU	1.030666	.0047035	219.13	0.000	1.021443	1.039889
_cons	-.0001058	.0000482	-2.19	0.028	-.0002004	-.0000112

Figure 6: Equation (2) outputs for the French stock index, with Newey-West standard errors with 5 lags

```
. newey IndexReturn imp_ann MSCIEMU, lag(5)

Regression with Newey-West standard errors      Number of obs     =      2,560
maximum lag: 5                                  F(  2,      2557) =   23606.40
                                                Prob > F          =    0.0000
```

IndexReturn	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
imp_ann	-.0002329	.0007382	-0.32	0.752	-.0016804	.0012146
MSCIEMU	1.030378	.004766	216.19	0.000	1.021032	1.039723
_cons	-.0001107	.0000475	-2.33	0.020	-.0002039	-.0000175

Figure 7: Equation (2) outputs for the French stock index, with Newey-West standard errors with 5 lags (anticipation effects)

```
. newey IndexReturn imp_anna MSCIEMU, lag(5)

Regression with Newey-West standard errors      Number of obs     =      2,560
maximum lag: 5                                  F(  2,      2557) =   23522.76
                                                Prob > F          =     0.0000
```

IndexReturn	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
imp_anna	-.0000507	.0006884	-0.07	0.941	-.0014006	.0012992
MSCIEMU	1.030306	.004758	216.54	0.000	1.020976	1.039636
_cons	-.0001112	.0000477	-2.33	0.020	-.0002047	-.0000177

Figure 8: Equation (2) outputs for the French stock index, with Newey-West standard errors with 5 lags (delayed effects)

```
. newey IndexReturn imp_annd MSCIEMU, lag(5)

Regression with Newey-West standard errors      Number of obs     =      2,560
maximum lag: 5                                  F(  2,      2557) =   23933.46
                                                Prob > F          =     0.0000
```

IndexReturn	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
imp_annd	-.0005389	.0004197	-1.28	0.199	-.0013619	.0002842
MSCIEMU	1.030608	.0047679	216.15	0.000	1.021259	1.039957
_cons	-.0001074	.0000477	-2.25	0.024	-.0002009	-.0000139

Figure 9: Equation (3) outputs for the French stock index, with Newey-West standard errors with 5 lags

```
. newey IndexReturn UNCV_SURP MSCIEMU, lag(5)

Regression with Newey-West standard errors      Number of obs     =      2,560
maximum lag: 5                                  F(  2,      2557) =   24628.83
                                                Prob > F          =     0.0000
```

IndexReturn	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
UNCV_SURP	.004793	.002963	1.62	0.106	-.0010172	.0106031
MSCIEMU	1.030973	.0047935	215.08	0.000	1.021573	1.040372
_cons	-.0001083	.0000475	-2.28	0.023	-.0002014	-.0000151

Table 4: Equation (1) outputs for national stock indices

	Market	Program					
Country/Region	**MSCI EMU Index**	**LTRO**	**CBPP**	**SMP**	**OMT**	**TLTRO**	**APP**
All Countries	0,8980***	0,0007	0,0005	-0,0025	-0,0027	-0,0020	0,0048***
North	0,9001***	-0,0003	0,0014	-0,0101***	-0,0031	-0,0005	0,0016
GIIPS	0,8950***	0,0021	-0,0007	0,0082	-0,0021	-0,0042	0,0094***
IPS	0,9562***	0,0011	0,0027	0,0184***	0,0015	0,0013	0,0099***
Austria	0,9718***	0,0026	0,0007	-0,0142**	-0,0006	-0,0010*	0,0090**
Belgium	0,8375***	-0,0011	0,0053	0,0030	-0,0022	-0,0012*	0,0020
Finland	0,8696***	-0,0000	0,0003	-0,0082***	-0,0056	-0,0001	-0,0061***
France	1,0306***	-0,0008	0,0006*	-0,0057***	-0,0008	-0,0003	-0,0015***
Germany	0,9648***	-0,0023**	-0,0014	-0,0262***	-0,0031	-0,0018	-0,0051***
Greece	0,7692***	0,0052	-0,0107*	-0,0073	-0,0150	-0,0224	0,0152*
Ireland	0,8324***	0,0018	-0,0015	-0,0071**	0,0002	-0,0026	0,0021
Italy	1,1020***	0,0007	0,0025	0,0122**	0,0008	0,0008	0,0106***
Luxembourg	0,7000***	-0,0006	0,0033	-0,0081	-0,0061***	-0,0015	0,0011
Netherlands	0,9269***	-0,0013	0,0008	-0,0120***	-0,0038	0,0013*	-0,0013
Portugal	0,7412***	0,0026	0,0061	0,0155	0,0006	0,0014	0,0097***
Spain	1,0255**	-0,0000	-0,0005	0,0276***	0,0032	0,0005	0,0093***

All regressions are estimated with Newey-West standard errors with 5 lags. North includes: Austria, Belgium, Finland, France, Germany, Luxembourg and Netherlands. GIIPS includes: Greece, Ireland, Italy, Portugal and Spain. IPS includes: Italy, Portugal and Spain. * Denotes significance at the 10% level, ** denotes significance at the 5% level and *** denotes significance at the 1% level.

Table 5: Equation (2) outputs for national stock indices

	Market	Program		
Country/Region	**MSCI EMU Index**	**IMP_ANN**	**IMP_ANN anticipation**	**IMP_ANN delayed**
All Countries	0,8971***	0,0010	0,0004	0,0008
North	0,8995***	-0,0010	-0,0003	-0,0005
GIIPS	0,8937***	0,0036	0,0015	0,0026*
IPS	0,9543***	0,0080***	0,0043***	0,0044***
Austria	0,9680***	0,0042	0,0032	0,0013***
Belgium	0,8380***	0,0026	0,0010	0,0008
Finland	0,8684***	-0,0011	0,0005	0,0010
France	1,0304***	-0,0003	-0,0002	-0,0005
Germany	0,9661***	-0,0085***	-0,0039**	-0,0037***
Greece	0,7670***	-0,0003	-0,0009	0,0019
Ireland	0,8336***	-0,0053*	-0,0038*	-0,0016
Italy	1,1002***	0,0058***	0,0036**	0,0045**
Luxembourg	0,6988***	-0,0010	-0,0001	0,0013
Netherlands	0,9265***	-0,0021	-0,0019	-0,0020
Portugal	0,7389***	0,0085**	0,0049*	0,0048***
Spain	1,0238***	0,0096**	0,0043*	0,0043*

All regressions are estimated with Newey-West standard errors with 5 lags. North includes: Austria, Belgium, Finland, France, Germany, Luxembourg and Netherlands. GIIPS includes: Greece, Ireland, Italy, Portugal and Spain. IPS includes: Italy, Portugal and Spain. The dummies "IMP_ANN anticipation" and "IMP_ANN delayed" incorporate a two-day event window, in order to capture anticipation and delayed effects. * Denotes significance at the 10% level, ** denotes significance at the 5% level and *** denotes significance at the 1% level.

Table 6: Equation (3) outputs for national stock indices

	Market	Monetary Surprise
Country/Region	**MSCI EMU Index**	**Unconventional Surprise**
All Countries	0,8977***	0,0018
North	0,9006***	0,0119
GIIPS	0,8937***	-0,0105
IPS	0,9525***	-0,0354***
Austria	0,9700***	0,0018
Belgium	0,8375***	-0,0066
Finland	0,8710***	0,0205***
France	1,0310***	0,0048*
Germany	0,9690***	0,0441**
Greece	0,1869***	-0,0478
Ireland	0,8348***	0,0230***
Italy	1,100***	-0,0200***
Luxembourg	0,6989***	0,0040
Netherlands	0,9257***	0,0169
Portugal	0,7380***	-0,0303*
Spain	1,0200***	-0,0559***

All regressions are estimated with Newey-West standard errors with 5 lags. North includes: Austria, Belgium, Finland, France, Germany, Luxembourg and Netherlands. GIIPS includes: Greece, Ireland, Italy, Portugal and Spain. IPS includes: Italy, Portugal and Spain. The "Unconventional Surprise" dummy measures the change in spread between German and Italian 10-year bond yields during the days of "Important Announcements". * Denotes significance at the 10% level, ** denotes significance at the 5% level and *** denotes significance at the 1% level.

Table 7: Equation (1) outputs for sector stock indices

	Market	Program					
Sector	**MSCI EMU Index**	**LTRO**	**CBPP**	**SMP**	**OMT**	**TLTRO**	**APP**
Automobile & Parts	1,0235***	0,0115	-0,0004	-0,0381***	-0,0082	-0,0041	-0,0050
Banks	1,4005***	0,0018	0,0019	0,0368***	0,0047	0,0019	0,0181*
Basic Resources	1,2931***	-0,0022	0,0053	-0,0334***	-0,0158*	0,0029*	0,0041
Chemicals	0,9379***	-0,0025	-0,0027	-0,0220***	-0,0008	-0,0020	-0,0086***
Construction & Materials	1,1313***	-0,0050	-0,0015	-0,0104***	-0,0045*	0,0022*	0,0019***
Financial Services	0,9687***	-0,0026	-0,0033	-0,0111	-0,0143***	-0,0000	0,0055***
Food & Beverages	0,6222***	-0,0012	0,0066	-0,0050***	0,0017	-0,0020*	-0,0084**
Healthcare	0,6604***	0,0046	0,0022	-0,0156***	0,0052***	-0,0042*	-0,0097
Industrial Goods & Services	1,0119***	-0,0058	-0,0001	-0,0217***	-0,0061	0,0009	-0,0024
Insurance	1,2361***	-0,0005	0,0034	0,0095***	-0,0027	0,0039*	0,0042***
Media	0,7390***	0,0049*	0,0003	-0,0096	-0,0044	-0,0016	-0,0016
Oil & Gas	1,0063***	-0,0001	0,0033	-0,0065	0,0048***	0,0069*	-0,0071*
Personal & Household Goods	0,8388***	-0,0044	-0,0056***	-0,0138***	0,0007	-0,0021	-0,0060*
Real Estate	0,8207***	0,0034	0,0030	-0,0190**	-0,0080***	-0,0009	0,0085
Retail	0,7561***	0,0000	0,0013	-0,0067***	0,0037***	-0,0033***	-0,0082***
Technology	0,8830***	-0,0068	-0,0061	-0,02900***	-0,0058	0,0002	0,0043***
Telecommunications	0,7903***	0,0029	-0,0019	0,0076***	-0,0033	-0,0023	0,0021
Travel & Leisure	0,7815***	-0,0018	-0,0038	-0,0202***	0,0015	-0,0058***	0,0025
Utilities	0,8803***	-0,0056**	-0,0014	-0,0110	0,0003	0,0008	0,0149***

All regressions are estimated with Newey-West standard errors with 5 lags. * Denotes significance at the 10% level, ** denotes significance at the 5% level and *** denotes significance at the 1% level.

Table 8: Equation (2) outputs for sector stock indices

	Market	Program		
Sector	**MSCI EMU Index**	**IMP_ANN**	**IMP_ANN anticipation**	**IMP_ANN delayed**
Automobile & Parts	1,0200***	-0,0047	-0,0003	-0,00047
Banks	1,3981***	0,0123***	0,0073**	0,0077**
Basic Resources	1,2900***	-0,0035	0,0000	-0,0033
Chemicals	0,9394***	-0,0071**	-0,0029	-0,0035**
Construction & Materials	1,1304***	-0,00096	-0,0007	-0,0015
Financial Services	0,9675***	-0,0050	-0,0027	-0,0046**
Food & Beverages	0,6220***	0,0041	0,0007	-0,0001
Healthcare	0,6618***	-0,0040*	-0,0022	-0,0026**
Industrial Goods & Services	1,0124***	-0,0052	-0,0025	-0,0023
Insurance	1,2363***	0,0003*	0,0012	0,0005
Media	0,7381***	-0,0027	-0,0018	-0,0016
Oil & Gas	1,0059***	0,0004	-0,0001	0,0014
Personal & Household Goods	0,8399***	-0,0042***	-0,0019**	-0,0036**
Real Estate	0,8134***	0,0093*	0,0061	0,0045*
Retail	0,7578***	-0,0025	0,0000	-0,0020
Technology	0,8827***	-0,0070*	-0,0049*	-0,0051*
Telecommunications	0,7892***	0,0026*	0,0011	0,0007
Travel & Leisure	0,7815***	-0,0036	-0,0000	-0,0029
Utilities	0,8787***	0,0005	-0,0015	0,0021

All regressions are estimated with Newey-West standard errors with 5 lags. The dummies "IMP_ANN anticipation" and "IMP_ANN delayed" incorporate a two-day event window, in order to capture anticipation and delayed effects. * Denotes significance at the 10% level, ** denotes significance at the 5% level and *** denotes significance at the 1% level.

Table 9: Equation (3) outputs for sector stock indices

	Market	Monetary Surprise
Sector	**MSCI EMU Index**	**Unconventional Surprise**
Automobile & Parts	1,0231***	0,0385*
Banks	1,3932***	-0,0687***
Basic Resources	1,2956***	0,0518***
Chemicals	0,9409***	0,0308*
Construction & Materials	1,1323***	0,0158**
Financial Services	0,9711***	0,0394***
Food & Beverages	0,6223***	-0,0091
Healthcare	0.6618***	0,0119
Industrial Goods & Services	1,0158***	0,0385***
Insurance	1,2352***	-0,0085*
Media	0,7391***	0,0132
Oil & Gas	1,0067***	0,0039
Personal & Household Goods	0,8405***	0,0162**
Real Estate	0,8178***	0,0042
Retail	0,7577***	-0,0065
Technology	0,8868***	0,0487***
Telecommunications	0,7886***	-0,0114***
Travel & Leisure	0,7836***	0,0245***
Utilities	0,8809***	0,0137

All regressions are estimated with Newey-West standard errors with 5 lags. The "Unconventional Surprise" dummy measures the change in spread between German and Italian 10-year bond yields during the days of "Important Announcements". * Denotes significance at the 10% level, ** denotes significance at the 5% level and *** denotes significance at the 1% level.